

CLAIMS

What is claimed is:

- 1 1. A thermoelectric apparatus, comprising:
2 a first electrode;
3 a dielectric material proximate said first electrode;
4 a second electrode opposing said first electrode with said dielectric material
5 deposited therebetween; and
6 at least one nano-wire extending between said first electrode and said second
7 electrode.

- 1 2. The apparatus of claim 1, wherein said at least one nano-wire comprises a
2 bismuth containing material.

- 1 3. The apparatus of claim 1, wherein said dielectric material comprises a
2 porous dielectric material.

- 1 4. The apparatus of claim 3, wherein said porous dielectric material
2 comprises porous alumina.

- 1 5. The apparatus of claim 1, further comprising a negatively charged trace
2 electrically connected to said first electrode and a positively charged trace to said second
3 electrode.

1 6. A thermoelectric package, comprising:
2 a microelectronic die having at least one area of which is of a higher heat
3 dissipation rate than the remainder of the microelectronic die when in operation;
4 a first electrode proximate said microelectronic die including said higher heat
5 area;
6 a dielectric material proximate said first electrode;
7 a second electrode opposing said first electrode with said dielectric material
8 disposed therebetween; and
9 a plurality of nano-wires extending between said first electrode and said second
10 electrode.

1 7. The package of claim 6, wherein said nano-wires are dispersed in a higher
2 density proximate said at least one higher heat dissipation rate area.

1 8. The package of claim 6, wherein said at least one nano-wire comprises a
2 bismuth containing material.

1 9. The package of claim 6, wherein said dielectric material comprises a
2 porous dielectric material.

1 10. The package of claim 9, wherein said porous dielectric material comprises
2 porous alumina.

1 11. The package of claim 6, further comprising a negatively charged trace
2 electrically connected to said first electrode and a positively charged trace to said second
3 electrode.

1 12. A method comprising:
2 providing a first electrode;
3 disposing a dielectric material proximate said first electrode;
4 forming at least one nano-scale opening through the dielectric material;
5 disposing a conductive material within said at least one nano-scale opening to
6 form at least one nano-wire which contacts said first electrode; and
7 forming a second electrode opposing said first electrode with said dielectric
8 material deposited therebetween, wherein said second electrode contacts said at least one
9 nano-wire.

1 13. The method of claim 12, wherein disposing said conductive material
2 comprising disposing a bismuth containing material.

1 14. The method of claim 12, wherein disposing said dielectric material
2 comprises disposing a porous dielectric material.

1 15. The method of claim 14, wherein disposing said porous dielectric material
2 comprises disposing porous alumina.

1 16. The method of claim 12, further comprising forming a negatively charged
2 trace electrically connected to said first electrode and forming a positively charged trace
3 to said second electrode.

1 17. A method comprising:
2 providing a first electrode;
3 disposing a porous dielectric material proximate said first electrode;
4 disposing a conductive material on said porous dielectric material, wherein said
5 conductive material extends through at least one opening in said porous material to form
6 at least one nano-wire which contacts said first electrode; and
7 forming a second electrode opposing said first electrode with said dielectric
8 material deposited therebetween, wherein said second electrode contacts said at least one
9 nano-wire.

1 18. The method of claim 17, wherein disposing said conductive material on
2 said porous dielectric material comprises disposing a bismuth containing material on said
3 porous dielectric material.

1 19. The method of claim 19, wherein disposing said porous dielectric material
2 comprises disposing porous alumina.

1 20. The method of claim 17, further comprising forming a negatively charged
2 trace electrically connected to said first electrode and forming a positively charged trace
3 to said second electrode.

1 21. An electronic system, comprising:
2 an external substrate within a housing; and
3 at least one microelectronic device package attached to said external substrate,
4 having at least thermoelectric device including:
5 a first electrode;
6 a dielectric material proximate said first electrode;
7 a second electrode opposing said first electrode with said dielectric
8 material deposited therebetween; and
9 at least one nano-wire extending between said first electrode and said
10 second electrode;
11 an input device interfaced with said external substrate; and
12 a display device interfaced with said external substrate.

1 22. The system of claim 21, wherein said at least one nano-wire comprises a
2 bismuth containing material.

1 23. The system of claim 21, wherein said dielectric material comprises a
2 porous dielectric material.

1 24. The system of claim 23, wherein said porous dielectric material comprises
2 porous alumina.

1 25. The system of claim 21, wherein said thermoelectric device further
2 comprises a negatively charged trace electrically connected to said first electrode and a
3 positively charged trace to said second electrode.